Leveraging Social Networks to Embed Trust in Rideshare Programs

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Abstract
Traffic congestion, high gas price and inadequate public transportation are major challenges for any country, business or individual. The traditional approach to solving these problems has been to improve public transportation and use greener energy. These approaches require huge investment, research and time, and can only be carried out by governments or businesses. An alternative solution seeks to reduce the number of vehicles on the road based on ridesharing. Nevertheless, ridesharing is not a popular form of public transportation.

In this paper, we summarize the results of a rideshare needs assessment survey conducted within the [university] community. The purpose behind this study was to understand commuter travel patterns, their needs and to identify their preferences for private vehicles and public transit for a variety of travel needs. Our results indicate that users are willing to increase participation in ridesharing programs if three core issues are addressed – trust, convenience and incentives.

1. Introduction

The United States had 4.6% of the world population but consumed 21.8% of the world’s energy (102 quadrillion BTUs of energy) in 2007 [21]. Energy is mainly needed for industry, transportation, and residential and other commercial purposes. The share of transportation alone is 29% of the total consumption. The biggest challenge by such large energy consumption is greenhouse gas emissions, mainly carbon dioxide (CO2) that are considered to be the major cause of global warming [21]. The total US carbon dioxide emission in 2006 was 5,890 million metric tons, with the transportation share being 34% of the total. This indicates that in order to reduce carbon dioxide emissions and its dangerous consequences, making transportation more efficient is a crucial step.

Government policies and individuals travel preferences are two effective ways that can have a big impact on the environment. In the United States, automobiles are the preferred mode for short distance travel [22]. Passenger transportation is dominated by automobiles, which account for 86% of total passenger miles traveled [22]. Government can create laws for strict emission norms that result in energy efficient vehicles. Some environmentally conscious individuals have changed their travel habits resulting in the success of hybrid and electric cars.

For this paper, public transportation is defined as a mode of passenger travel that is available to the general public. Thus commercial airplanes, trains, buses and taxis can be considered public transportations. Ridesharing or carpooling is a privately organized shared use of a passenger vehicle for commuting purposes. The arrangement for ridesharing may involve paying the vehicle owner a small fee. A more popular arrangement involves rotational sharing of their vehicle by different owners, without exchange of money. Therefore, ridesharing can also be considered a form of public transportation.

In most American cities, single-occupied automobiles make the majority of commutes [22]. Assuming that most cars can seat a maximum of 4 passengers, every car in the street is being utilized only 25%. This fact motivated us to try to identify the problems that prevent commuters from fully utilizing the passenger capacity of a car, which will help reduce the number of cars driven and consequently reduce pollution that contributes to global environmental problems.

We conducted a survey to understand the travel habits of individuals for a variety of their needs – either short distance or long distance. Surveys represent one of the most effective methods for quantitative social science research. We chose to conduct a survey over other methods because of limited availability of primary data dealing with relationships between social networks, ridesharing systems and mobile devices – the three basic embodiments of our research. Through our survey, we want to understand the people’s concerns about using ridesharing as a means of public transportation. We are aware that several ridesharing systems and tools exist, but we would like to understand the problems faced by
users in organizing and coordinating a rideshare using these systems.

The results of the survey indicate several key issues that exist today. Although the rideshare system sounds like a fairly simple concept, it is not so, and hence not used widely. There are three main reasons why these systems have not gained many users in the past. First, there are system level difficulties in scheduling a ride; it involves enormous planning and complexities. Second, there is social discomfort that arises due to lack of trust amongst co-passengers. It turns out that trust in co-passengers is the most important factor why people are not willing to give or take rides from others. We learned that users prefer choosing their co-passenger. Finally, there seems to be lack of incentives or motivation for people to share rides.

The data obtained in this study will help us design a ride-share system that facilitates quick and easy organization of rideshare while maintaining a high level of trust among the rideshare participants.

2. Background

Trust as defined by Mayer and Davis [16] “is the willingness of a party to be vulnerable to the actions of another party based on expectations that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party”. Trust has been mentioned as the willingness to take risk. Cook and Wall [6] have defined trust in terms of confidence as “the extent to which one is willing to ascribe good intentions to and have confidence in the words and actions of other people”. Trust has also been defined in terms of predictability; both together reduce uncertainty [16]. People have their preferences in trusting another individual. Familiarity has been considered an important condition for trust [14]. A stranger is considered less trustworthy than parents [16]. People tend to trust their family members, friends and acquaintances more to establish mutual dependence compared to others [11].

In case of rideshare systems, the driver and passenger play the role of both trustor and trustee. Trust is one of the major concerns of users of ridesharing systems [17]. To address this problem, solutions have been proposed to localize a ridesharing application in a more closed environment like workplace, university [20] that to some extent eliminates the fear of sharing rides with strangers. Most of the systems Goloco [26], NuRide [30], ERideShare [31], provide features like user profile that give basic information about driver and passenger and a rating system that adds credibility to the users and thus increases trust.

Social network sites allow individuals to organize themselves as a group or community based on shared interest, views and background [1,4]. Common features of these sites are profiles, friends list, comments and testimonials. The display of social connections between users is a crucial component of social network sites [4].

Some of the widely used social network sites are Facebook [10], MySpace [18] and Friendster [5]. They allow users to interact with strangers and friends. However, the interactions are frequently between “latent ties” [12] that have pre-existing social connection of some form such as a shared workplace or a classroom. As suggested by Elison et al. [9], people use Facebook mainly to maintain existing offline connections. Most of the social networks today are built on users extended social network [4].

Social software systems can also be mobile-specific, such as Dodgeball [13]. Given the ubiquity of mobile systems, the web-based systems also have mobile interfaces to continuously involve its users. The mobile devices range from simple mobile phones, smart phones, iPods and even laptops. Recent devices like the iPhone have changed the way people interact, work and have fun. These mobile handsets give another dimension to social software in the form of location awareness. Systems like Loopt [28], help in locating friends on a map. Sitting in a coffee shop, one can now find if their friends are nearby [8, 19].

Even though social network sites have a lot to offer, they are plagued by trust and privacy concerns [3]. In a study Dwyer et al. [7] compared two popular social network sites Facebook and Myspace, focusing mainly on trust and privacy concerns associated with usage of these sites. The study results indicate that users trust Facebook more when it comes to sharing information and developing new online relationship.

Jennifer et al. [15] show how social network sites can be used as a ground for educating users about their ecological impact on environment. According to them by displaying information on energy efficiency and consumption on these sites we can motivate users to reduce their ecological footprints.

Integrating ridesharing with social networks can address the problem of trust related with ridesharing systems. Zimride [29] is one such application that has been integrated with social network sites like MySpace and Facebook. For example, Facebook users can request for rides or offer rides to members of their university community. Even though members may not know each other directly, they share a common ground, in this case a university, with a higher level of trust.
3. Survey Design

The goal of the survey is to understand a commuter’s daily travel requirements and patterns and to understand the role of trust in the context of shared travel. We wanted to capture and assess the problems preventing people from using public transportation like buses, trains and ridesharing.

The target population for our survey is a small university town composed of students, faculty and staff. We used a random sampling method and divided the population into separate groups based on gender and age. This was necessary since perspective of these groups is expected to vary widely. The survey was hosted online and participants were notified through email. Though Internet-based questionnaires provide little control over respondent selection, it is fast to conduct, inexpensive and avoids interviewer bias or distortion.

Prior to framing the questionnaire, we conducted interviews with representatives of some of the rideshare services available in the university. We wanted to find out how successful these services were, whether users were motivated to use them, and other problems these services were facing. The three main issues identified were: 1) lack of awareness about the availability of ridesharing services, 2) hesitancy among users to form rides with strangers, and 3) loss of freedom while participating in such programs. We also learned that commuting expense is the biggest motivating factor to use ridesharing. These interviews combined with the literature related to this research helped us frame an initial set of questions for our survey.

A mock survey of 25 questions was initially posted to a group of 10 students and faculty for pretest. The questions were formulated in-house to capture perceptions of trust, travel modes and problems, general use of existing ride-sharing programs and the willingness to develop new relationships. The questions were mainly close-ended with ordered and unordered responses. A few questions were partially close-ended, giving the respondents extra flexibility to describe their response. The results and feedback from the pretest was used to rephrase, add and delete questions. The final questionnaire was comprised of 26 questions. We used an online survey tool provided by our university to post the survey. Posting was made through email invitation to faculty and student mailing lists. To ensure a large number of participants, we sent email reminders every week for three weeks while the survey was open, after which it was closed for analysis.

4. Results and Analysis

A total of 125 participants (71 females, 54 males) responded of which 88% were students and remaining 12% were faculty and staff. Most participants were 20-30 years of age and all were members of the university community. There was no incentive of any kind to participate in the survey. About 86% of the participants reported they are located off-campus where 60% live more than 5 miles from campus. The distance measure indicates that most people must be using some means of travel such as a car, bike or some form of public transportation. Thus, 49% of the participants use their car for daily commute to school or work, while 36% take the bus. The remaining either bike or walk to campus.

Some of our results confirm that our target population was accurately chosen. Firstly, most of them have a daily travel requirement of 5 miles or more. Secondly, 81% of them own cars. This aligns with our goal to reduce the number of cars on the road. The huge number of cars also provides us with reasons to develop a public transit system by using these same cars as resources. Additionally, 18% who don’t own a car solely rely on public transit or friends for their daily travel needs.

![Figure 1. Mode of transportation for daily commuting (Number of people versus transportation mode)](image)

4.1. Existing rideshare systems

There were 9 questions dedicated to understanding the strengths and weaknesses of existing rideshare systems. We found out that ridesharing systems are not a popular option for a variety of reasons.

4.1.1. Awareness. There are at least 4 websites that allow members of this community to find and share rides online – Craigslist [23], RIDESolutions [24], Campus Ride Board [25] and Goloco [26]. However 69% of the participants are not aware of any such program. Out of those who have heard about a carpool
option, only 13% had made use of a ridesharing website. From comments received from participants, it seemed that some have used social networking websites like Facebook [9] or community based mailing lists for obtaining rides.

**4.1.2. Inconvenience.** Existing rideshare systems are not easy to use and do not provide some desired functionality. About 54% of the participants blame complications in finding and setting up rides as the major reason for not sharing rides. Apart from complexity and coordination, 86% of participants think that the bigger problem is lack of flexibility in travel, with the biggest factor being inability to handle last minute changes in travel plans. They usually have to travel at the time set by the car owner. Even if a ride is available, getting to a car owner or carpool lot is inconvenient as very often the person requesting the ride is required to meet at the car’s location. Users would prefer pickup and drop off closer to them. Such a service is possible only if the car owner and passengers are living close to each other or if the ride seeker lives along the route of the trip.

Another matter of inconvenience is that travelers – either car owner or co-passengers - may have to sacrifice their personal preferences, such as transporting their pets, stopping too often or not enough, smoking or even the amount of luggage that can be carried.

**4.1.3. Trust.** Second only to inconvenience, 41% of our survey respondents think that it would be difficult to trust the person offering or requesting a ride. This is evident from the questions regarding the kind of people they would want to give and accept a ride from. Trust is not only tied to one’s ability to know the other person, but also to factors such as driving skills and smoking in the car. We discuss the trust factor for ridesharing in more depth in Section 4.4.

**4.1.4. Availability.** Ridesharing is almost always carefully planned and requires immense co-ordination – online or offline. On a question why people would not prefer to share rides, some indicated that rides are usually not available for short distances (< 50 miles), since it is a hassle to arrange for one. Since most of the arrangement is done online, it is difficult to arrange for a ride when a person is away from his computer, say for example in a shopping complex. In other words, it is very difficult to find rides on the go.

**4.2. Travel patterns**

Most people travel short distance most of the time. Naturally, short trips, like travel to work or home, are more frequent than long trips. The participants are mainly living in a small college town in Virginia with a reputed public bus transit system. Despite this, only 36% participants take the bus to work on a daily basis. Most, 49%, still prefer to drive everyday. Only a small number, 7%, share rides in some form for travel to work or nearby short distances.

Of all the public transportation options available, people mostly use city bus service for their daily needs such as traveling to campus, shopping or going to the airport. The reasons for using buses vary. Many use the bus service because they don’t own a car. A number of students don’t drive to campus because it’s difficult to find parking. Some people also prefer using the bus during inclement weather, usually to avoid adverse driving conditions or to prevent damage to their personal vehicle. A majority of the participants prefer to use bus when they go out for parties, so that they can avoid driving after consuming alcohol.

Our results show that 72% of the participants do not use or are less likely to use ridesharing for local events or shopping. Their behavior is the same for daily commuting, such as travel to work or school, with 67% participants expressing their unwillingness to share rides. These results could be attributed to the fact that carpooling is an inconvenient option and requires planning and coordination.

In contrast, when it comes to ridesharing for longer distances, 56% participants would like to go the extra mile to find one. Naturally, long distance travels are not very frequent and ridesharing could significantly reduce costs for the journey.

**4.3. Social Networking**

Understanding a user’s social relationship and network is critical for ridesharing systems. The important questions are – would anyone trust people beyond their social network? How does trust vary with depth in a social network hierarchy?

Most of the participants of the survey are relatively new to the city they live in (average 1.5 years in town) and most of them are students. Having been in a place for a relatively short duration means that their local social network may not be very large. Here we see a potential for a ride sharing system acting as a platform for developing new social ties.

Local communities and organizations play an important role developing social relationships. 65% of the participants are member of at least one community group. Out of the remaining 34% percent - 13% who have been living in and around campus for more than 4 years (even 20 years and above) are not a member of any group or organization. Either they don't like socializing or don't have a means to participate.
People belong to church and student associations, among other groups. People usually gather face-to-face for community group meetings and events. Based on the participants’ comments, we learned that such events are usually organized at places that are not so well connected. Any gathering at an inconvenient location will provide a good opportunity for ridesharing, thereby not only achieving the goal of using fewer vehicles, but also increasing direct communication between members of that group.

With Internet penetration currently at 74.4% in the US [27], some of the most popular platforms for developing social ties in this digital age are online social networks. Given the young age of the participants, almost 53% use some sort of social networking websites on a daily basis, and an additional 35% use such services at-least once a month. Having said that, such online tools can be leveraged to connect people for activities such as ridesharing.

Social networking tools are useful at connecting people that are more likely to trust one another and might really help encourage carpooling. They could provide a great opportunity for people to make more friends and engage in more social activities than they otherwise would. For example, a user wanting to go to Wal-Mart might look at their trip as an opportunity to hang out with a new friend; the purpose of the trip has completely shifted from one of just getting to Wal-Mart to one of making a social connection.

Social networking is taking a new turn with the increasing availability of Internet on mobile devices. This means you carry your social connections everywhere you go and have ability to socialize while on the move. 53% of our participants had mobile phones with Internet connectivity, which reflects the growing trend in mobile phone usage.

### 4.4. Trust factor

Many people treat carpooling as a blind date, where they strongly hope the person they’re sharing the ride with to behave as they expect. People seek trust in the form of personal security, that is, no mistreatment of any kind. Further, people want to trust the competency of the driver, that is, good driving skills and valid drivers license. Trust plays different roles in both scenarios – accepting rides and giving rides.

#### 4.4.1. Accepting Rides

We asked participants to specify the type of individuals they would accept rides from. We found out that 98% of them were happy to accept rides from their friends. While this was not surprising, we also found that 69% would also accept rides from the friend of a friend. When it comes to communities, 69% would accept rides from people of their community, and 50% would accept rides from people belonging to the university community. Only 7% would accept rides from strangers. The percentages are strongly related to the strength of the social relationship between them.

#### 4.4.2. Giving Rides

When we asked participants their preferences in giving rides to people, 99% said they were most comfortable offering rides to their friends, while 82% would give a ride to the friend of a friend. Again the trend is similar to accepting rides, except that there are a slightly higher percentage of people who would give rides rather than accept rides. Interestingly, people are even slightly more comfortable in giving rides to strangers, than taking one from them.
friend of a friend or member of a shared community, 67% responded they would request a ride, up from 7% if they were strangers. Similarly, if such a system could identify their social relationship with someone who is seeking a ride, 66% are more likely to offer one, up from 10% if they thought they were strangers.

4.5. Benefits of ridesharing

Ridesharing is not popular and is often seen as an inconvenient means of travel. However, it can be made fun provided the users see an incentive in using it. The biggest factor that attracts people to ridesharing is cost. 82% of the respondents say they would like to save costs by ridesharing. The other convenient factor is that ridesharing could also allow drop off and pick up. This is particularly useful in places where parking is a real problem - 62% would actually rideshare to reduce parking problems at their destination.

Next to costs, people are aware of the effect transportation has on the environment. 69% said they would rideshare because they would like to be environmentally friendly.

Traffic congestion is not isolated to larger cities. Considering the fact that all participants were from a small college town, 37% of the participants face traffic congestion sometimes and another 9% always. Congestion in large cities is expected to be a much bigger problem. Therefore, a significant 38% also would like to rideshare to avoid traffic congestion. Reducing congestion is not only good for the environment, but will also help people reach their destination on time.

Ridesharing can be thought of as a social event. Some people may not like driving long distances alone and they often try to find out if they could find a travel companion.

4.6. Use of ridesharing

Ridesharing has similar transportation usages as public forms of transportation, such as buses, trains, taxis or sometimes even airplanes. We asked the participants 3 questions about the purpose of the travel for which they would use ridesharing. The results are summarized below.

4.6.1. Local events and shopping. 72% of the participants are unlikely to use ridesharing for shopping or local events, suggesting that shopping is really a personal thing to do at one's own convenience. Only 21% would use ridesharing for local events. This figure is similar to the percentage of people without a car.

4.6.2. Commuting to work or school. The results are similar to local events and shopping. About 67% are unlikely to use ridesharing for their daily commutes. Perhaps, the inconveniences of arranging rides and differences in schedules have a role to play in this particular case.

4.6.3. Vacation and long distance trips. Of all, long distance trips are the most popular rideshare purpose. 56% of the participants would use ridesharing for such activities. Long distance trips are infrequent and so the inconvenience of scheduling a ride is offset by the savings in cost. Longer trips also require more than one driver to avoid exhaustion. Additionally, long drives can be more fun, since the rideshare may turn into a social activity.

5. Discussion

The results show that although people seem to be interested in ridesharing, it remains an unpopular mode of transportation. A general unawareness of ridesharing websites is a clear signal about the lack of interest in such systems. The most important reasons for its unpopularity are the inconvenience, lack of trust and motivation.

Complications in finding and setting up a ride, the amount of co-ordination required and lack of flexibility mainly cause the inconveniences. One solution to this problem would be to improve the usability of the tool that enables ridesharing. Another solution would be to increase the number of members willing to participate in ridesharing. Having a large user-base would increase the availability of rides, which in turn would enable greater flexibility in choosing a schedule.

We identified trust to be a major factor that people consider while offering or accepting a ride. Any person is many times more willing to offer or take a ride from another person with whom there exists a social relationship even indirectly. Therefore, we look forward to promoting ridesharing amongst friends.

![Figure 4. Motivating factors for ridesharing](image)
friends of friends and communities based on common social networks. Immediate friends are without doubt the best travel mates, but friends of friends are the ones that can increase the number of participants in the ride sharing program. For example, consider the case where John has 100 friends and each of them have another 100 friends whom John has never met or known directly. However, if John decides to take rides from friends of his friends, he will have 10,000 people from whom he can take rides with a high level of confidence and trust. Social networks provide this kind of extended relationships and are the best means to reach a larger population, without compromising greatly on the trust factor.

Our survey respondents reported they are willing to participate in ridesharing provided they are able to trust all occupants in the car. However, very few agreed to share rides for local events, shopping or their daily commute to work. Long rides are more popular for ridesharing, primarily due to the cost factor. This gives us insight that there should be a clear motivation for people to participate, be it financial or otherwise. Apart from low costs, there are several people who can be motivated based on environmental concerns such as air pollution and global warming.

6. Conclusions and Future Work

In this paper we have presented the results and analysis of a survey to understand the role of trust and social networks ridesharing as a mode of public transportation. The survey questions captured the concerns and problems that users face while trying to use existing ridesharing systems.

Our results indicate that there are 3 important factors that people consider when participating in any kind of ridesharing system – convenience, trust and motivation. Scheduling a ride is a difficult process and consumes a lot of time due to immense planning and coordination. As a result, very few users would use ridesharing for unplanned events such as shopping or visiting nearby friends. Since more people travel short distances than longer ones, it is important to promote ridesharing in this space.

Trust is a major factor that determines how comfortable people are while participating in ridesharing. The results indicate that a user’s willingness to participate in ridesharing is proportional to the level of trust in the co-passengers. Friends are the best people to share rides with, but friends of friends and shared local communities are also trusted choices. However there is a need for a social networking based tool that connects these slight distant relationships and therefore increase the number of potential participants in the ride-sharing program.

The results and analysis of this survey will be used to make an informed design of a ridesharing system that addresses issues of social discomfort and convenience of scheduling rides. The data collected from this research can also be shared with companies offering ridesharing solutions, but are struggling with membership and participation.

We are confident that members of a social network express trust not only in direct relationships but also in indirect ones. Thus we can leverage these social ties when designing a ridesharing system. It is often difficult to arrange for a ride mainly due to lack of information on available rides and pre-planning. Mobile devices such as mobile phone and internet-enabled music players are the perfect means for obtaining information instantaneously and ‘on the go’ whenever required.

Based on these principles, we propose to design an instantaneous ridesharing system for members of an online social community. Our mobile device based system will not only leverage social ties, but also make use of features such as GPS to provide rides available in the vicinity and phone numbers to negotiate meeting places and incentives. Ideally, our users would be able to post and view rides as soon as the mobile device is out of their pocket. Finally, we would like to provide incentives and motivation to people to consider ridesharing as a good alternative to their personal vehicles. Incentives can be financial, environmental or simply convenience in setting up rides.

We hope that our ridesharing system, when deployed will conform to the results in this paper and serve as a valuable tool for further research in the areas of trust, social networks and ridesharing systems.

7. References


